IN THE CLAIMS

The following listing of the claims is provided in accordance with 37 C.F.R. §1.121:

1. (currently amended) A system for generating X-rays, the system comprising:

a high repetition rate laser source disposed in a vacuum cavity and adapted to generate and direct high-energy optical pulses in a first direction in [~~a~~] the vacuum ~~laser~~ cavity; and

a source of a pulsed electron beam adapted to generate and direct the pulsed electron beam in a second direction opposite to the first direction in the ~~laser~~ vacuum cavity, the pulsed electron beam impacting photons in the optical pulses in the ~~laser~~ vacuum cavity to produce X-rays in the second direction.

2. (currently amended) The system of claim 1, further comprising a plurality of mirrors located in the ~~laser~~ vacuum cavity for confining the optical pulses within the ~~laser~~ vacuum cavity.

3. (original) The system of claim 2, wherein the plurality of mirrors are arranged in a ring configuration.

4. (currently amended) The system of claim 1, further comprising an isolator located in the ~~laser~~ vacuum cavity for directing the optical pulses in the first direction.

5. (original) The system of claim 1, wherein the high energy optical pulses comprise high repetition rate, mode-locked optical pulses.

6. (currently amended) The system of claim 5, further comprising an acousto-optic cell located in the ~~laser~~ vacuum cavity for generating the high repetition rate, mode-locked optical pulses.

7. (currently amended) The system of claim 5, further comprising an electro-optic cell and a Brewster plate located in the ~~laser~~ vacuum cavity for generating the high repetition rate, mode-locked optical pulses.

8. (currently amended) The system of claim 1, wherein the high repetition rate laser source comprises ~~further comprising~~ a solid state laser rod ~~located in the laser cavity~~ for generating the optical pulses.

9. (original) The system of claim 8, wherein the solid state laser rod is a Yb:YAG laser rod.

10. (currently amended) The system of claim 1, further comprising a grating located in the ~~laser~~ vacuum cavity for temporally stretching the optical pulses.

11. (currently amended) The system of claim 1, further comprising a grating located in the ~~laser~~ vacuum cavity for temporally compressing the optical pulses.

12. (previously presented) The system of claim 1, wherein the source of the pulsed electron beam is a radio frequency linear accelerator.

13. (currently amended) The system of claim 1, further comprising one or more magnets to direct the pulsed electron beam in the second direction in the ~~laser~~ vacuum cavity.

14. (currently amended) The system of claim 1, further comprising one or more Bragg reflectors to direct the X-rays in a pre-determined direction from the ~~laser~~ vacuum cavity.

15. (currently amended) A system for generating X-rays, the system comprising:

a mode-locked laser source disposed in a vacuum cavity and adapted to generate and direct high-energy optical pulses in a first direction in [a] the vacuum ~~laser~~ cavity; and

a source of a pulsed electron beam adapted to generate and direct the pulsed electron beam in a second direction opposite to the first direction in the ~~laser~~ cavity, the pulsed electron beam impacting photons in the optical pulses in the ~~laser~~ vacuum cavity to produce X-rays in the second direction.

16. (currently amended) The system of claim 15, further comprising an isolator located in the ~~laser~~ vacuum cavity for directing the optical pulses in the first direction.

17. (original) The system of claim 15, wherein the high energy optical pulses comprise high repetition rate, mode-locked optical pulses.

18. (currently amended) The system of claim 17, further comprising an acousto-optic cell located in the ~~laser~~ vacuum cavity for generating the high repetition rate, mode-locked optical pulses.

19. (currently amended) The system of claim 17, further comprising an electro-optic cell and a Brewster plate located in the ~~laser~~ vacuum cavity for generating the high repetition rate, mode-locked optical pulses.

20. (previously presented) The system of claim 15, wherein the source of the pulsed electron beam is a radio frequency linear accelerator.

21. (currently amended) The system of claim 15, further comprising one or more magnets to direct the pulsed electron beam in the second direction opposite to the first direction in the ~~laser~~ vacuum cavity.

22. (currently amended) A system for generating X-rays, the system comprising:

a mode-locked laser source disposed in a vacuum cavity and adapted to generate high-energy optical pulses in [a] the vacuum ~~laser~~ cavity, the vacuum cavity having a ring configuration[,];

~~the laser including~~ an isolator located in the vacuum cavity for directing the optical pulses in a first direction; and

a source of a pulsed electron beam adapted to generate and direct the pulsed electron beam in a second direction opposite to the first direction in the ~~laser~~ vacuum cavity, the pulsed electron beam impacting photons in the optical pulses in the ~~laser~~ vacuum cavity to produce X-rays in the second direction.

23. (original) The system of claim 22, wherein the high energy optical pulses comprise high repetition rate, mode-locked optical pulses.

24. (currently amended) The system of claim 23, further comprising an acousto-optic cell located in the ~~laser~~ vacuum cavity for generating the high repetition rate, mode-locked optical pulses.

25. (currently amended) The system of claim 23, further comprising an electro-optic cell and a Brewster plate located in the ~~laser~~ vacuum cavity for the generating high repetition rate, mode-locked optical pulses.

26. (previously presented) The system of claim 22, wherein the source of the pulsed electron beam is a radio frequency linear accelerator.

27. (currently amended) The system of claim 22, further comprising one or more magnets to direct the pulsed electron beam in the second direction opposite to the first direction in the ~~laser~~ vacuum cavity.

28. (currently amended) A system for generating X-rays, the system comprising:

a mode-locked laser source disposed in a vacuum cavity and adapted to generate and direct high-energy optical pulses in a first direction in [~~a~~] the vacuum ~~laser~~ cavity; and

a source of a pulsed electron beam adapted to feed the pulsed electron beam in an electron storage ring overlapping the ~~laser~~ vacuum cavity, the electron storage ring adapted to circulate the pulsed electron beam in a second direction opposite to the first direction in the ~~laser~~ vacuum cavity, the pulsed electron beam impacting photons in the optical pulses in the ~~laser~~ vacuum cavity to produce X-rays in the second direction.

29. (currently amended) The system of claim 28, further comprising an isolator located in the ~~laser~~ vacuum cavity for directing the optical pulses in the first direction.

30. (original) The system of claim 28, wherein the high energy optical pulses comprise high repetition rate, mode-locked optical pulses.

31. (currently amended) The system of claim 30, further comprising an acousto-optic cell located in the ~~laser~~ vacuum cavity for generating the high repetition rate, mode-locked optical pulses.

32. (currently amended) The system of claim 30, further comprising an electro-optic cell and a Brewster plate located in the ~~laser~~ vacuum cavity for generating the high repetition rate, mode-locked optical pulses.

33. (previously presented) The system of claim 28, wherein the source of the pulsed electron beam is a radio frequency linear accelerator.

34. (previously presented) The system of claim 28, wherein the electron storage ring is adapted to store and circulate the pulsed electron beam.

35. (currently amended) The system of claim 28, wherein a round trip circulation time of the pulsed electron beam in the electron storage ring is substantially equivalent to a round trip time of the optical pulses in the ~~laser~~ vacuum cavity.

36. (previously presented) The system of claim 28, wherein the electron storage ring further includes an amplifier to accelerate the pulsed electron beam circulating in the electron storage ring.

37. (currently amended) A system for generating X-rays, the system comprising:

a mode-locked laser source disposed in a vacuum cavity and adapted to generate high-energy optical pulses in [a] the vacuum ~~laser~~ cavity, the vacuum cavity having a ring configuration[,];

~~the laser including~~ an isolator located in the vacuum cavity for directing the optical pulses in a first direction; and

a source of a pulsed electron beam adapted to feed the pulsed electron beam in an electron storage ring overlapping the ~~laser~~ vacuum cavity, the electron storage ring adapted to circulate the pulsed electron beam in a second direction opposite to the first

direction in the ~~laser~~ vacuum cavity, the pulsed electron beam impacting photons in the optical pulses in the ~~laser~~ vacuum cavity to produce X-rays in the second direction.

38. (original) The system of claim 37, wherein the high energy optical pulses comprise high repetition rate, mode-locked optical pulses.

39. (currently amended) The system of claim 38, further comprising an acousto-optic cell located in the ~~laser~~ vacuum cavity for generating the high repetition rate, mode-locked optical pulses.

40. (currently amended) The system of claim 38, further comprising an electro-optic cell and a Brewster plate located in the ~~laser~~ vacuum cavity for generating the high repetition rate, mode-locked optical pulses.

41. (previously presented) The system of claim 37, wherein the source of the pulsed electron beam is a radio frequency linear accelerator.

42. (previously presented) The system of claim 37, wherein the electron storage ring is adapted to store and circulate the pulsed electron beam.

43. (currently amended) The system of claim 37, wherein a round trip circulation time of the pulsed electron beam in the electron storage ring is substantially equivalent to a round trip time of the optical pulses in the ~~laser~~ vacuum cavity.

44. (previously presented) The system of claim 37, wherein the electron storage ring further includes an amplifier to accelerate the pulsed electron beam circulating in the electron storage ring.

45. (previously presented) A method for generating X-rays, the method comprising:

generating high-energy optical pulses in a ~~laser~~ vacuum cavity via a high repetition rate laser source disposed in the vacuum cavity, the optical pulses being directed in a first direction;

generating a pulsed electron beam; and

directing the pulsed electron beam into the ~~laser~~ vacuum cavity in a second direction opposite to the first direction, photons in the optical pulses impacting the pulsed electron beam to generate X-rays in the second direction.

46. (currently amended) The method of claim 45, further comprising confining the optical pulses within the ~~laser~~ vacuum cavity via a plurality of mirrors located in the ~~laser~~ vacuum cavity.

47. (original) The system of claim 45, wherein the high energy optical pulses comprise high repetition rate, mode-locked optical pulses.

48. (currently amended) The method of claim 47, further comprising generating the high repetition rate, mode-locked optical pulses via an acousto-optic cell located in the ~~laser~~ vacuum cavity.

49. (currently amended) The method of claim 47, further comprising generating the high repetition rate, mode-locked optical pulses via an electro-optic cell and a Brewster plate located in the ~~laser~~ vacuum cavity.

50. (currently amended) The method of claim 45, further comprising temporally stretching the optical pulses via a grating located in the ~~laser~~ vacuum cavity.

51. (currently amended) The method of claim 45, further comprising temporally compressing the optical pulses via a grating located in the ~~laser~~ vacuum cavity.